The Skill-Content of Green Technologies and Occupations

Davide Consoli[1] Giovanni Marin[2,3] Alberto Marzucchi[1,3,4] Francesco Vona[5]

[1]INGENIO, CSIC-UPV Valencia, Spain
[2]CERIS-CNR, Milano, Italy
[3]SEEDS Sustainability Environmental Economics and Dynamics Studies, Italy
[4]Catholic University of Milano, Italy
[5]OFCE Sciences Po, Nice, France

ISS Conference 2014
Jena, July 2014

Green structural change

- The **technological** and **structural** transition towards **low carbon economies** (or, more generally, **green economy**) generate opportunities and challenges
- **Expectation** that **employment** effects are going to be **positive** (Bezdek et al., 2008)...
- ...and they **actually** seem to be **positive** (e.g. Licht and Peters, 2013; Gagliardi et al., 2014)
- '**Green New Deal**' as a way out of the (**unemployment**) crisis

The gap

- Still **limited** discussion/assessment on the specific **effects** of the **transition** towards a **green economy** on **employment** and occupations
  - Job **creation** vs job **destruction**
  - Creation of **new occupations** vs reallocation across **existing occupations**
  - Change in the **skill/task contents** of occupations driven by green technological change and structural change
  - **Distributional** effects (i.e. wages)
- **Lack** of **analysis** on **occupational skill content** limits the capacity to design **interventions** via **education** and **training**
- Occupational skill content - the **task model**
  - **Skills** are **individual abilities** needed for **performing work and tasks** activities in a certain occupation (Autor et al, 2003; Levy and Murnane, 2004)
  - **Industry evolution** $\Rightarrow$ two types of changes
    1. Occupation **birth/death**
    2. **Change** in **task content** of continuing occupations

The gap

- Still **limited** discussion/assessment on the specific **effects** of the **transition** towards a **green economy** on **employment** and occupations
  - Job **creation** vs job **destruction**
  - Creation of **new occupations** vs reallocation across **existing occupations**
  - Change in the **skill/task contents** of occupations driven by green technological change and structural change
  - **Distributional** effects (i.e. wages)
- **Lack** of **analysis** on **occupational skill content** limits the capacity to design **interventions** via **education** and **training**
- Occupational skill content - the **task model**
  - **Skills** are **individual abilities** needed for **performing work and tasks** activities in a certain occupation (Autor et al, 2003; Levy and Murnane, 2004)
  - **Industry evolution** $\Rightarrow$ two types of changes
    1. Occupation **birth/death**
    2. **Change** in **task content** of continuing occupations

Research questions

1. **Size** and occupational **distribution** of **green jobs**
2. **Task and skill content** of green jobs
3. **Exposure** of green jobs to general and 'specific' (green) **technological change**
4. Assessment of the extent to which '**specific**' (green) **technological change** affects (or is related to) **skill/task** content of occupations

O*NET database

- **O*NET** is a database of **worker attributes** and **job characteristics** (task, skills, etc.)
- **US**-level occupations (more than **900** at 8-digit, about **750** at 6-digit)
- The **skill content** of each occupation is **continuously revised** over time reflecting **task reconfiguration** within each occupation
- Uses **Standard Occupational Classification** (SOC) system and can hence be **matched with other sources** of occupational information such as the US Bureau of Labor Statistics (**BLS**)
- We **merge O*NET** data with **BLS employment shares by occupation** and 4-digit NAICS **sectors**
- Sectoral dimension crucial to build **proxies of technology exposure** (R&D, investments) to capture relevant rate and direction of technological change
- Recent efforts to **identify green occupations** and collect information on green occupations (Dierdoroff et al., 2009; 2011)
  - Green increased **demand** occupations
  - Green enhanced **skills** occupations
  - Green new and **emerging** occupations

O*NET database

- **O*NET** is a database of **worker attributes** and **job characteristics** (task, skills, etc.)
- **US**-level occupations (more than **900** at 8-digit, about **750** at 6-digit)
- The **skill content** of each occupation is **continuously revised** over time reflecting **task reconfiguration** within each occupation
- Uses **Standard Occupational Classification** (SOC) system and can hence be **matched with other sources** of occupational information such as the US Bureau of Labor Statistics (**BLS**)
- We **merge O*NET** data with **BLS employment shares by occupation** and 4-digit NAICS **sectors**
- Sectoral dimension crucial to build **proxies of technology exposure** (R&D, investments) to capture relevant rate and direction of technological change
- Recent efforts to **identify green occupations** and collect information on green occupations (Dierdoroff et al., 2009; 2011)
  - Green increased **demand** occupations
  - Green enhanced **skills** occupations
  - Green new and **emerging** occupations

Baseline task/skill indicators

- **Routine** vs **Non-Routine** task/skill content of occupations
  - **Routine Manual** (RM) e.g.'Handling and Moving Objects'
  - **Routine Cognitive** (RC) e.g. 'Monitor Processes, Materials, or Surroundings'
  - **Non-Routine Analytical** (NRA) e.g. 'Making Decisions and Solving Problems'
  - **Non-Routine Interactive** (NRI) e.g. 'Selling or Influencing Others'
- **Routine** tasks could be performed also by '**machines**', while **Non-Routine** (generally) **cannot**
- For ease of exposition, here we **focus** on **Routine** vs **Non-Routine**

▸ Routine ▸ Non-routine

Alternative Green Economy Skill Indicators

- Skill selection based on **textual analysis** of **policy reports** on Green Economy (ILO, CEDEFOP, etc.)

Table: Green tasks and skills

MAINTENANCE AND REPAIRING	Equipment Maintenance	Repairing & Maintaining Mechanical Equipment	Repairing & Maintaining Electronic Equipment	**Installation**
CONTROL	Quality Control Analysis	Inspecting Equipment, Structures, or Material	**Control Precision**	**Operation & Control**
ENGINEERING AND DESIGN	Design	Technology Design	**Science**	**Engineering & Technology**
INTERPERSONAL	Resolving Conflicts & Negotiating with Others	Negotiation	**Sales & Marketing**	**Provide Consultation & Advice to Others**
SYSTEM THINKING	Social Perceptiveness	**Systems Analysis**	**Systems Evaluation**	

Exposure indicators

- **Employment** shares (number of employees by **occupation** and **industry**) from **BLS** (Bureau **of** Labor Statistics) ⇒ average **2011-2012**
- **Overall** capital **investment** from **CENSUS** (average **2009-2010**)
- **Total** and **energy** + **environmental R&D** investment from **NSF** (National Science Foundation) for the years **2008-2010**

$$Exposure_{occ} = \sum_{ind} \left(\frac{Tech\_change_{ind}}{Lab_{ind}} \times Emp\_share_{occ,ind} \right)$$

Exposure indicators

- **Employment** shares (number of employees by **occupation** and **industry**) from **BLS** (Bureau **of** Labor Statistics) ⇒ average **2011-2012**
- **Overall** capital **investment** from **CENSUS** (average **2009-2010**)
- **Total** and **energy + environmental R&D** investment from **NSF** (National Science Foundation) for the years **2008-2010**

$$Exposure_{occ} = \sum_{ind} \left(\frac{Tech\_change_{ind}}{Lab_{ind}} \times Emp\_share_{occ,ind} \right)$$

Exposure indicators

- **Employment** shares (number of employees by **occupation** and **industry**) from **BLS** (Bureau **of** Labor Statistics) ⇒ average **2011-2012**
- **Overall** capital **investment** from **CENSUS** (average **2009-2010**)
- **Total** and **energy + environmental R&D** investment from **NSF** (National Science Foundation) for the years **2008-2010**

$$Exposure_{occ} = \sum_{ind} \left(\frac{Tech\_change_{ind}}{Lab_{ind}} \times Emp\_share_{occ,ind} \right)$$

Exposure indicators

- **Employment** shares (number of employees by **occupation** and **industry**) from **BLS** (Bureau **of** Labor Statistics) ⇒ average **2011-2012**
- **Overall** capital **investment** from **CENSUS** (average **2009-2010**)
- **Total** and **energy + environmental R&D** investment from **NSF** (National Science Foundation) for the years **2008-2010**

$$Exposure_{occ} = \sum_{ind} \left(\frac{Tech\_change_{ind}}{Lab_{ind}} \times Emp\_share_{occ,ind} \right)$$

Green workers in the US: quantitative assessment

Table: Share of workers in green occupations by macro-occupation

SOC 2-digit	Share
11 - Management	48.52%
13 - Business and Financial Operations	16.45%
15 - Computer and Mathematical	13.64%
17 - Architecture and Engineering	68.51%
19 - Life, Physical, and Social Science	50.31%
21 - Community and Social Service	-
23 - Legal	0.67%
25 - Education, Training, and Library	0.15%
27 - Arts, Design, Entertainment, Sports, and Media	16.89%
29 - Healthcare Practitioners and Technical	1.13%
31 - Healthcare Support	-
33 - Protective Service	0.22%
35 - Food Preparation and Serving Related	-
37 - Building and Grounds Cleaning and Maintenance	-
39 - Personal Care and Service	-
41 - Sales and Related	2.83%
43 - Office and Administrative Support	5.44%
45 - Farming, Fishing, and Forestry	5.19%
47 - Construction and Extraction	67.03%
49 - Installation, Maintenance, and Repair	57.04%
51 - Production	47.30%
53 - Transportation and Material Moving	52.98%
Total	18.78%

Profiling of green occupations (I)

- Is there a **systematic difference** in the **technology exposure** and **skill content** between **green** and **non-green occupations**?

$$y_i = \beta Green_i^{0,1} + \sum_j \gamma_j D\_SOC^j + \varepsilon_i \quad (1)$$

Profiling of green occupations (II)

Table: Profiling of green occupations - classical aggregate skill measures

	Difference	S.E.	Average	Diff/Average
Non-Routine	0.0588*	(0.0319)	3.02	0.019
Routine	0.0843***	(0.0187)	2.67	0.032
Engineer-Design	0.235***	(0.0332)	1.69	0.139
Control	0.177***	(0.0398)	2.35	0.075
Mainten-Repair	0.146***	(0.0337)	1.61	0.091
Interpersonal	0.0341	(0.0398)	2.68	0.013
System thinking	0.0315	(0.0353)	2.68	0.012

OLS weighted (number of employees) regressions. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. SOC 2-digit dummies included. N=665.

- Green occupations relatively **more Routine** intensive
- **Strictly technical** (routine) skills are a **distinguishing** feature of **green occupations** $\Rightarrow$ robust to controlling for heterogeneity across macro-occupations
- **Non-technical** green skills (interpersonal and 'system thinking') are **not distinctive** features of green occupations

Profiling of green occupations (II)

Table: Profiling of green occupations - classical aggregate skill measures

	Difference	S.E.	Average	Diff/Average
Non-Routine	0.0588*	(0.0319)	3.02	0.019
Routine	0.0843***	(0.0187)	2.67	0.032
Engineer-Design	0.235***	(0.0332)	1.69	0.139
Control	0.177***	(0.0398)	2.35	0.075
Mainten-Repair	0.146***	(0.0337)	1.61	0.091
Interpersonal	0.0341	(0.0398)	2.68	0.013
System thinking	0.0315	(0.0353)	2.68	0.012

OLS weighted (number of employees) regressions. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. SOC 2-digit dummies included. N=665.

- Green occupations relatively **more Routine** intensive
- **Strictly technical** (routine) skills are a **distinguishing** feature of **green occupations** $\Rightarrow$ robust to controlling for heterogeneity across macro-occupations
- **Non-technical** green skills (interpersonal and 'system thinking') are **not distinctive** features of green occupations

Differences in exposure to technological change between green and non-green occupations

	(1) log(Env R&D)	(2) log(Env R&D)	(3) log(Env R&D)
Green occupation	0.261***	0.254***	0.153***
	(0.0529)	(0.0526)	(0.0469)
log(Tot R&D)	0.810***	0.817***	0.815***
	(0.0147)	(0.0149)	(0.0210)
R sq	0.968	0.963	0.973
F	1696.6	1744.6	1169.7
N	746	665	394

OLS weighted (number of employees) regressions. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. SOC 2-digit dummies included in column 1 and 2, SOC 4-digit dummies included in column 3.

- **Green occupations** are more **exposed** to **green technological change** (energy and environmental R&D intensity)
- Results **robust** to the **exclusion** of macro-occupations (2 or 4 digit) without any green occupation and **controlling** for **overall exposure** to **technological** change

Differences in exposure to technological change between green and non-green occupations

	(1) log(Env R&D)	(2) log(Env R&D)	(3) log(Env R&D)
Green occupation	0.261***	0.254***	0.153***
	(0.0529)	(0.0526)	(0.0469)
log(Tot R&D)	0.810***	0.817***	0.815***
	(0.0147)	(0.0149)	(0.0210)
R sq	0.968	0.963	0.973
F	1696.6	1744.6	1169.7
N	746	665	394

OLS weighted (number of employees) regressions. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. SOC 2-digit dummies included in column 1 and 2, SOC 4-digit dummies included in column 3.

- **Green occupations** are more **exposed** to **green technological change** (energy and environmental R&D intensity)
- Results **robust** to the **exclusion** of macro-occupations (2 or 4 digit) without any green occupation and **controlling** for **overall exposure** to **technological** change

Econometric specifications

- Does **green technological change** exposure correlate **differently** with the skill content of **green occupations** as opposed to other occupations?

$$y_i = \theta Green_i^{0,1} + \lambda Green\_tech_i + \pi Green\_tech_i \times Green_i^{0,1} + \phi Non\_green\_tech_i + \\ + \delta Non\_green\_tech_i \times Green_i^{0,1} + X_i'\omega + \sum_j \mu_j D\_SOC^j + \xi_i \quad (2)$$

	Routine	Non-Routine	Engineer-Design	Control	Mainten-Repair	Interpersonal	System thinking
Green occupation	-0.136	-0.0874	0.289	0.0470	-0.0957	-0.104	-0.340
	(0.140)	(0.227)	(0.284)	(0.311)	(0.271)	(0.286)	(0.275)
log(Env R&D)	0.0269	0.0368	0.147***	0.0962*	0.0927**	0.0224	0.0715
	(0.0314)	(0.0418)	(0.0486)	(0.0556)	(0.0441)	(0.0468)	(0.0572)
log(Non-env R&D)	-0.0270	-0.0305	-0.0475	-0.0952*	-0.0392	-0.0328	-0.0520
	(0.0279)	(0.0392)	(0.0416)	(0.0495)	(0.0375)	(0.0434)	(0.0523)
log(Env R&D)	-0.0777	0.00651	0.0638	-0.159	-0.194*	-0.133	-0.0995
X Green occupation	(0.0551)	(0.0730)	(0.155)	(0.140)	(0.115)	(0.0932)	(0.0941)
log(Non-env R&D)	0.0839*	0.0100	-0.0671	0.131	0.163+	0.112	0.113
X Green occupation	(0.0507)	(0.0712)	(0.130)	(0.122)	(0.103)	(0.0908)	(0.0909)
log(Inv tot)	-0.0137	0.0802***	0.0185*	-0.0201	-0.000770	0.0790***	0.0670***
	(0.0111)	(0.0147)	(0.0109)	(0.0292)	(0.0130)	(0.0166)	(0.0204)
E(Green|X)	0.0774**	0.00957	0.126*	0.209*	0.124**	0.0489	-0.0274
	(0.0375)	(0.0539)	(0.0711)	(0.107)	(0.0619)	(0.0638)	(0.0629)
R sq	0.646	0.520	0.751	0.776	0.786	0.551	0.547
F	37.54	20.80	50.35	73.40	55.95	25.46	23.35
N	665	665	665	665	665	665	665

OLS weighted (number of employees) regressions. Robust standard errors in parentheses. +p<0.15 * p<0.1, ** p<0.05, *** p<0.01. SOC 2-digit dummies included.

- **Routine** vs **Non-Routine** ⇒ **expected** results
  - log(Non env R&D)*Green occ>0 ⇒ effect of **knowledge codification** ⇒ **general** R&D is **complementary** to **Routine** skills
  - Capital **investments** (including ICTs) complements **Non-Routine** skills
- **Environmental R&D** is complementary to **green technical** skills
- **General** R&D has a **substitution** effect on **control** ⇒ more advanced in the **life cycle** as opposed to Green R&D
- **Capital** is complementary to **high-level** skills ⇒ Engineering, Interpersonal and System Thinking

	Routine	Non-Routine	Engineer-Design	Control	Mainten-Repair	Interpersonal	System thinking
Green occupation	-0.136	-0.0874	0.289	0.0470	-0.0957	-0.104	-0.340
	(0.140)	(0.227)	(0.284)	(0.311)	(0.271)	(0.286)	(0.275)
log(Env R&D)	0.0269	0.0368	0.147***	0.0962*	0.0927**	0.0224	0.0715
	(0.0314)	(0.0418)	(0.0486)	(0.0556)	(0.0441)	(0.0468)	(0.0572)
log(Non-env R&D)	-0.0270	-0.0305	-0.0475	-0.0952*	-0.0392	-0.0328	-0.0520
	(0.0279)	(0.0392)	(0.0416)	(0.0495)	(0.0375)	(0.0434)	(0.0523)
log(Env R&D)	-0.0777	0.00651	0.0638	-0.159	-0.194*	-0.133	-0.0995
X Green occupation	(0.0551)	(0.0730)	(0.155)	(0.140)	(0.115)	(0.0932)	(0.0941)
log(Non-env R&D)	0.0839*	0.0100	-0.0671	0.131	0.163+	0.112	0.113
X Green occupation	(0.0507)	(0.0712)	(0.130)	(0.122)	(0.103)	(0.0908)	(0.0909)
log(Inv tot)	-0.0137	0.0802***	0.0185*	-0.0201	-0.000770	0.0790***	0.0670***
	(0.0111)	(0.0147)	(0.0109)	(0.0292)	(0.0130)	(0.0166)	(0.0204)
E(Green|X)	0.0774**	0.00957	0.126*	0.209*	0.124**	0.0489	-0.0274
	(0.0375)	(0.0539)	(0.0711)	(0.107)	(0.0619)	(0.0638)	(0.0629)
R sq	0.646	0.520	0.751	0.776	0.786	0.551	0.547
F	37.54	20.80	50.35	73.40	55.95	25.46	23.35
N	665	665	665	665	665	665	665

OLS weighted (number of employees) regressions. Robust standard errors in parentheses. +p<0.15 * p<0.1, ** p<0.05, *** p<0.01. SOC 2-digit dummies included.

- **Routine** vs **Non-Routine** ⇒ **expected** results
  - log(Non env R&D)*Green occ>0 ⇒ effect of **knowledge codification** ⇒ **general** R&D is **complementary** to **Routine** skills
  - Capital **investments** (including ICTs) complements **Non-Routine** skills
- **Environmental R&D** is complementary to **green technical** skills
- **General** R&D has a **substitution** effect on **control** ⇒ more advanced in the **life cycle** as opposed to Green R&D
- **Capital** is complementary to **high-level** skills ⇒ Engineering, Interpersonal and System Thinking

Summing up

- **Profiling** of **green occupations** based on the **skill content** (using Autor et al, 2003, as a benchmark)
- **Five** specific **skill** categories ⇒ Engineering, Maintenance, Repair, Interpersonal, System Thinking ⇒ **green occupations** exhibit a strong **bias** towards **technical** skills (Engin, Maint, Repair)
- Compare **technology exposure** of green occupations vs non-green occupations ⇒ **green R&D complementary** to **green technical** skills
- **Consistent** with **skill life cycle** (Vona and Consoli, 2011) ⇒ emergent **green occupations** exhibit "**hands-on**" use of technology due to **low codification** of know-how

Summing up

- **Profiling** of **green occupations** based on the **skill content** (using Autor et al, 2003, as a benchmark)
- **Five** specific **skill** categories ⇒ Engineering, Maintenance, Repair, Interpersonal, System Thinking ⇒ **green occupations** exhibit a strong **bias** towards **technical** skills (Engin, Maint, Repair)
- Compare **technology exposure** of green occupations vs non-green occupations ⇒ **green R&D complementary** to **green technical** skills
- **Consistent** with **skill life cycle** (Vona and Consoli, 2011) ⇒ emergent **green occupations** exhibit "**hands-on**" use of technology due to **low codification** of know-how

THANK YOU FOR YOUR ATTENTION

g.marin@ceris.cnr.it

Routine tasks/skills

Table: Routine Manual

Code	Description
4A3a1	Performing General Physical Activities
4A3a2	Handling and Moving Objects
4A3a3	Controlling Machines and Processes
4A3a4	Operating Vehicles, Mechanized Devices, or Equipment
4C2d1b (cx)	Spend Time Standing
4C2d1c (cx)	Spend Time Climbing Ladders, Scaffolds, or Poles
4C2d1d (cx)	Spend Time Walking and Running
4C3b2 (cx)	Degree of Automation
4C2d1i (cx)	Spend Time Making Repetitive Motions
4C3d3 (cx)	Pace Determined by Speed of Equipment

Table: Routine Cognitive

Code	Description
4A1a2	Monitor Processes, Materials, or Surroundings
4A1b3	Estimating the Quantifiable Characteristics of Products, Events, or Information
4A2b5	Scheduling Work and Activities
4A3b2	Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment
4A3b6	Documenting/Recording Information
4A4c1	Performing Administrative Activities
4A4c3	Monitoring and Controlling Resources
4C3b4 (cx)	Importance of Being Exact or Accurate
4C3b7 (cx)	Importance of Repeating Same Tasks
4C3b8 (cx)	Structured versus Unstructured Work

Back to presentation

Non-Routine tasks/skills

Table: Non-Routine Analytical

Code	Description
4A2a1	Judging the Qualities of Things Services, or People
4A2a3	Evaluating Information to Determine Compliance with Standards
4A2a4	Analyzing Data or Information
4A2b1	Making Decisions and Solving Problems
4A2b2	Thinking Creatively
4A2b3	Updating and Using Relevant Knowledge
4A2b6	Organizing, Planning, and Prioritizing Work
4A4a1	Interpreting the Meaning of Information for Others
4A4b1	Coordinating the Work and Activities of Others
4A4b2	Developing and Building Teams

Table: Non-Routine Interactive

Code	Description
4A4a2	Communicating with Supervisors, Peers, or Subordinates
4A4a3	Communicating with Persons Outside Organization
4A4a4	Establishing and Maintaining Interpersonal Relationships
4A4a6	Selling or Influencing Others
4A4a7	Resolving Conflicts and Negotiating with Others
4A4b3	Training and Teaching Others
4A4b4	Guiding, Directing, and Motivating Subordinates
4A4b5	Coaching and Developing Others
4A4b6	Provide Consultation and Advice to Others
4C1b1g (cx)	Coordinate or Lead Others

Back to presentation

Green occupations: definitions (Dierdoroff et al., 2009; 2011) I

- The process of **'greening'** of **occupations**:

  The **'greening' of occupations** *refers to the extent to which* **green economy** *activities and* **technologies** *increase the* **demand** *for* **existing** *occupations,* **shape the work and worker requirements** *needed for occupational performance, or* **generate unique** *work and worker* **requirements**

- Green **Increased Demand** Occupations (64 occupations)

  The impact of **green economy** *activities and technologies is an* **increase in the employment demand** *for an existing occupation. However, this impact* **does not entail significant changes** *in the work and worker* **requirements** *of the occupation. The work context may change, but the tasks themselves do not.*

Green occupations: definitions (Dierdoroff et al., 2009; 2011) I

- The process of **'greening'** of **occupations**:

  The **'greening' of occupations** *refers to the extent to which* **green economy** *activities and* **technologies** *increase the* **demand** *for* **existing** *occupations,* **shape the work and worker requirements** *needed for occupational performance, or* **generate unique** *work and worker* **requirements**

- Green **Increased Demand** Occupations (64 occupations)

  The impact of **green economy** *activities and technologies is an* **increase in the employment demand** *for an existing occupation. However, this impact* **does not entail significant changes** *in the work and worker* **requirements** *of the occupation. The work context may change, but the tasks themselves do not.*

Green occupations: definitions (Dierdoroff et al., 2009; 2011) II

- Green **Enhanced Skills** Occupations (61 occupations)

  The impact of **green economy** *activities and technologies results in a* **significant change** *to the work and worker* **requirements** *of an* **existing** *O*NET-SOC occupation. This impact* **may or may not** *result in an* **increase** *in employment* **demand** *for the occupation. The essential purposes of the occupation remain the same, but tasks, skills, knowledge, and external elements, such as credentials, have been altered.*

- **New and Emerging** (N&E) Green Occupations (26 occupations)

  The impact of **green economy** *activities and technologies is sufficient to create the* **need for unique work and worker requirements**, *which results in the generation of a* **new occupation** *relative to the O*NET taxonomy. This new occupation could be* **entirely novel or 'born' from an existing** *occupation.*

Green occupations: definitions (Dierdoroff et al., 2009; 2011) II

- Green **Enhanced Skills** Occupations (61 occupations)

  The impact of **green economy** *activities and technologies results in a* **significant change** *to the work and worker* **requirements** *of an* **existing** *O*NET-SOC occupation. This impact* **may or may not** *result in an* **increase** *in employment* **demand** *for the occupation. The essential purposes of the occupation remain the same, but tasks, skills, knowledge, and external elements, such as credentials, have been altered.*

- **New and Emerging** (N&E) Green Occupations (26 occupations)

  The impact of **green economy** *activities and technologies is sufficient to create the* **need for unique work and worker requirements**, *which results in the generation of a* **new occupation** *relative to the O*NET taxonomy. This new occupation could be* **entirely novel or 'born' from an existing** *occupation.*